Volume 22 Study R-I-A

STATE OF ALASKA

Jay S. Hammond, Governor

Annual Performance Report for

POPULATION STRUCTURE, MIGRATORY PATTERNS AND HABITAT REQUIREMENTS OF THE ARCTIC GRAYLING

by

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Job No.: R-I-A Job Title: Population Structure, Migratory Patterns and Habitat Requirements of the Arctic Grayling

Cooperator: Jerome Hallberg

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ABSTRACT

Complete data on age and length composition of fish sampled during population estimates on the lower Chena River are presented. Population estimates of Arctic grayling Thymallus arcticus (Pallas), greater than 150 millimeters fork length, conducted on four index sections of the lower 70 miles of the Chena River in 1980, showed increases in three areas over 1979 estimates. Grayling sampled in the four areas were predominantly immature evidenced by 96 percent that were less than 270 millimeters (10.5) inches fork length. Ages III and IV were the dominant age classes and represented over 60 percent of the sample. The mean fork length for each index area increased slightly in successive upstream sections. The mean fork length for all four sampling areas was 191 millimeters.

Creel census information collected from May 8 - September 30, 1980 along the upper Chena River revealed that 20,827 angler hours were expended to catch nearly 16,400 grayling, with a seasonal success rate of 0.78 fish per hour. Age Classes III and IV accounted for 57 percent of the grayling entering the creel. The average length of the grayling caught along the upper Chena River was 228 millimeters. Angler pressure and harvest figures by month, along with angler composition, creel census summary since 1970, and complete age and length composition of the creel are presented.

A total of 3,000 grayling, 150 millimeters fork length and greater, was tagged using Floy internal anchor tags to monitor intrastream movements. Early summer tag returns showed strong upstream movement in May and June. A small number of tag returns in late summer showed little movement.

The mean fork length of 3,269 grayling tagged or handled during tagging operations was 218 millimeters.

A status report on the construction of the Chena River Lakes Flood Control Project, now in its final stage, is presented.

BACKGROUND

The Chena River is typical of the clear, rapid-runoff type streams common to interior Alaska. Originating in the Tanana hills approximately 100 mi east of Fairbanks at lat. 65°N, long. 145°W, it flows in a westerly direction, emptying into the Tanana River 7 mi below the city of Fairbanks. The entire watershed occupies approximately 1,900 sq mi, with the river basin 100 mi long and a maximum of 40 mi wide. The flow of the Chena River at Fairbanks has an annual average of 1,418 cfs based on data collected by the U.S. Geological Survey since 1947. The maximum annual average was 3,160 cfs in 1949 and the minimum was 708 cfs in 1958. The 1967 flood accounted for the record maximum flow of 74,400 cfs through Fairbanks.

Like most clear runoff streams, the Chena River supports a large population of Arctic grayling, Thymallus arcticus (Pallas). While the Chena River contains many species of fish, the grayling is the principal species of recreational importance and the grayling fishery here is presently the largest in the state. Table 1 lists common and scientific names of all fish species mentioned in this report.

The Chena Hot Springs Road, which parallels the Chena River from Mile 26 to its terminus at Mile 60, crosses the river seven times, providing easy access for fishermen and recreationists alike. It is in this area of intense fishing pressure that the 1980 creel census was conducted. Also within this area the Alaska Department of Natural Resources, Division of Parks, has recently appropriated 250,000 acres to be used as a recreation area. The U.S. Army Corps of Engineers is presently constructing a flood control project on the Chena River at River Mile 47. The project is due to be completed in 1981 and is designed to channel flood waters from the upper Chena River directly into the Tanana River, bypassing the city of Fairbanks and the lower Chena, thus protecting both from flood waters.

Other factors affecting the river include the hot springs and resort on the North Fork, numerous recreation cabins on the North and West Forks, and a military campground near Mullen Slough. Hydraulic gold mining operations are active on the Little Chena River and the East Fork and mining activities are scheduled on the South and West Forks. These activities, along with the problems associated with a city and military complex located in the lower 15 mi of the river, pose a variety of management problems to the Sport Fish Division in our ongoing efforts to maintain the integrity of the Chena River and its fauna.

The river was divided into 17 sections (Fig. 1, Table 2); from these, four index sections were selected and population estimates were made to determine changes in the population structure.

Table 1. Scientific and common names of fish mentioned in this report.

Common Name	Scientific Name and Author	Abbreviation
Arctic grayling	Thymallus arcticus (Walbaum)	GR
Burbot	Lota lota (Linnaeus)	BB
Chinook salmon	Oncorhynchus tshawytscha (Walbaum)	KS
Chum salmon	Oncorhynchus keta (Walbaum)	CS
Humpback whitefish	Coregonus pidschian (Gmelin)	HWF
Least cisco	Coregonus sardinella Valenciennes	LCI
Longnose sucker	Catostomas catostomas (Forster)	LNS
Northern pike	Esox lucius Linnaeus	NP
Round whitefish	Prosopium cylindraceum (Pallas)	RWF

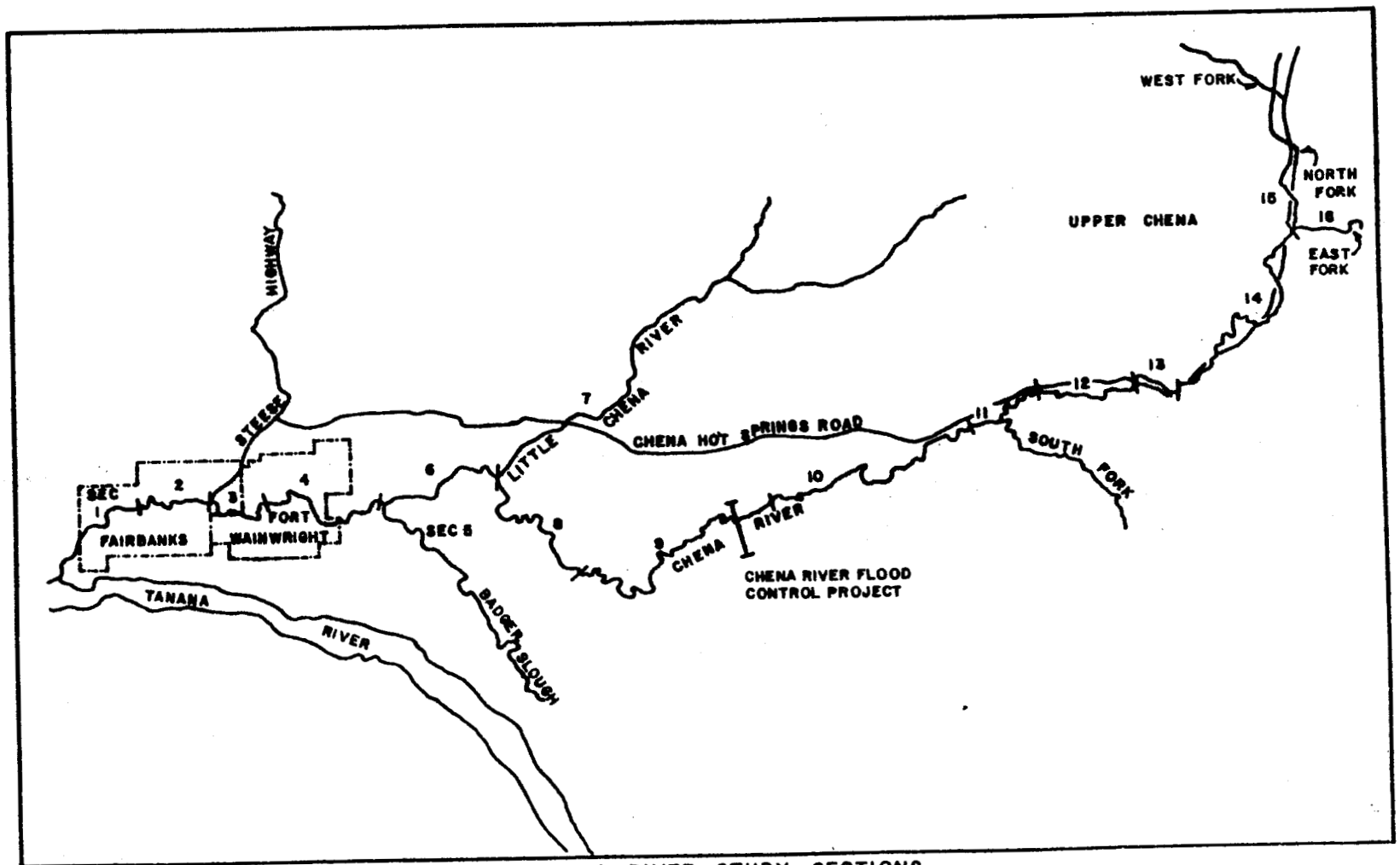

FIGURE I. CHENA RIVER STUDY SECTIONS

Table 2. Chena River study sections.

Section Number	Section Name	River Miles	Section Length Miles
1	River Mouth to University Ave.	0-6	6.0
2a	University Ave. to Peger Road	6-8	2.0
2b	Peger Road to Wendell Street	8-11	3.0
3	Wendell St. to Wainwright Railroad Bridge	11-14.5	3.5
4	Wainwright Railroad Bridge to Badger Slough	14.5-21.5	7.0
5	Badger Slough		16.5
6	Badger Slough to Little Chena	21.5-24.5	3.0
7	Little Chena River		61.5
8	Little Chena to Nordale Slough	24.5-31	24.5
9a	Nordale Slough to Bluffs	31-55.5	24.5
9b	Bluffs to Bailey Bridge	55.5-63	7.5
10	Bailey Bridge to Hodgins Slough	63-79	16.0
11	Hodgins Slough to 90 Mi. Slough	79-90	11.0
12	90 Mi. Slough to First Bridge	90-92	2.0
13	First Bridge to Second Bridge	92-94.5	2.5
14	Second Bridge to North Fork	94.5-102	7.5
15	North Fork of Chena River		35.0
16	East Fork of Chena River		62.0
17	West Fork of Chena River		35.0

Standard mark and recapture methods to estimate grayling numbers were initiated by Roguski and Winslow (1969), and continued by Roguski and Tack (1970), Tack (1971-1976) and Hallberg (1977-1980).

Information obtained during the population estimates also includes length frequencies, age and length composition, and annual survival rates, all of which aid in understanding grayling life history.

RECOMMENDATIONS

Research

It is recommended that:

1. Population estimates on index sections of the Chena River should be continued.

2. Investigations should continue on spring-fed streams and headwaters of major river systems in the Tanana drainage.

3. Tagging studies to determine Arctic grayling movements in the Chena River should be continued.

4. Creel census programs should be continued on the Chena River system with emphasis on obtaining statistically based catch data.

5. The grayling population structure in the upper Chena River in the area of heavy exploitation should be investigated.

Management

Monitoring of development projects affecting the Chena River should be continued.

Job Objectives:

1. To determine Arctic grayling populations and age class structure in index sections of the Chena River.

2. To determine angler use and harvest of grayling in the upper Chena River adjacent to the Chena Hot Springs Road.

3. To keep abreast of the development projects affecting the fish habitat of the Chena River and other tributaries of the Tanana drainage.

4. To conduct surveys on tributary streams of the Chena River.

5. To continue surveys on spring-fed streams tributary to the Tanana River between the Richardson Clearwater and Nenana.

TECHNIQUES USED

Grayling for tagging, population, and length composition studies were captured by a boat-mounted electrofishing unit described by Van Hulle (1968) and Roguski and Winslow (1969). Passes were made through each section on three successive days. Population estimates were made using the techniques of the Schumacher-Eschmeyer and Schnabel, as described in Ricker (1958).

Only grayling 150 mm and greater captured during the population and movements and migration studies were tagged using a numbered Floy internal anchor tag inserted in the dorsal musculature. Grayling scales used for age determination were individually cleaned and mounted on 20 mil acetate using a Carver press at 20,000 psi, heated to 200°F for 30 seconds. The scales were read on a Bruning 200 microfiche reader.

A roving creel census was conducted along the upper Chena River utilizing randomized angler counts. The census was conducted on three randomly selected weekdays per week and two weekend days per week. Only interviews with those anglers having completed their trip were used to compute the catch statistics and angler profile information.

Several types of other equipment were used in our research. A Hach Model AL-36-B water test kit was used to obtain water chemistry data. Multifilament and monofilament sinking or floating gill nets measuring 125 x 6 ft and consisting of five 25-ft panels of 0.5 in through 2.5 in bar mesh were used to capture fish in the newly created Chena Lake.

FINDINGS

Population Estimates

Population estimates on Arctic grayling in the Chena River were first conducted on two index areas, (Sections 2 and 6) in 1967 (Van Hulle 1968). Since then the index areas monitored have changed considerably, new areas have been added, some of the old areas have been split into two sections and some have been deleted. These estimates serve only as indicators of population trends, rather than providing exact numbers of individuals, and annual monitoring is necessary to detect fluctuations within the population. In order to obtain data with the greatest amount of reliability, standardization of the index areas and the techniques used is attempted. Section 2b from river miles 8-11, section 8a (river miles 27-30), the dam site area (river miles 45-48), and section 10b (river miles 66-69), best represent a cross-section of habitat types, use patterns, and areas experiencing both heavy and light development, and thus are currently used as the four index areas.

Section 2b and 8a both lie below the newly constructed Chena River Lakes Flood Control Project and may be directly impacted during times of flooding. Section 2b lies adjacent to Fairbanks, is easily accessible and has over the years been exposed to heavy development. Section 8a is a 3-mi

section located approximately 15 mi upstream of Fairbanks and, while this area remains fairly accessible, it has not yet experienced the development that section 2b has. The upper two sections are located above the flood control structure. The area known as the "Dam Site" is the 3 mi stretch of river directly upstream of the control structure, and it is in this area that flood waters from the Chena River enter the floodway and eventually find their way into the Tanana River. Estimates here began in 1972 (Tack 1973) and will be continued to monitor any changes in the grayling population structure as it relates to the flood control project. In 1970 a population estimate was done in the entire 16 mi length of section 10 (Tack 1971); none has been done since. This area is undeveloped, relatively inaccessible, and angler utilization is minimal; thus it serves as a control area in our population estimates.

Results of the 1980 population estimates are presented in Table 3, and a summary of population estimates conducted on the same index sections from 1968 to 1980 appear in Table 4.

Table 3 indicates that in section 2b and the dam site section, where we have information for a number of years, both areas have experienced considerable population fluctuations from year to year, and the overall trend has been downward. The population estimates in 1980 show an increase in both section 2b and the dam site section. Section 8a also showed an increased population over its first year as an index section in 1979. Section 10b has a larger population per mile than downstream index sections; the primary factors responsible are probably the section's location above most development and its lower accessibility to anglers. Another reason for the higher population may be that this area is heavily used for spawning by chinook and chum salmon which attract grayling to the section. In 1980 many grayling were observed concentrating at the downstream end of the salmon redds feeding on the salmon eggs as they drift downstream. Successive years' data will help explain the larger estimates in section 10b.

As was discussed last year (Hallberg 1980) when changes in the population estimates occur in the lower river, these fluctuations should be reflected in the harvest statistics and the size of the fish being caught in the upper Chena River. While the lower river estimates took a positive turn in 1980, the general trend over several years has been a decline. No indication of this decline appears in creel census results (refer to section on creel census) for 1980; the total catch and the average size of grayling harvested has remained stable.

Another consideration is the effect a new sewage disposal plant has had on the lower river. Prior to July, 1976, when the plant was put into operation, the City of Fairbanks and Ft. Wainwright discharged up to 3 million gallons of sewage effluent daily into the river. Because the new system discharges into the Tanana River instead, a significant decrease in nutrients reaching the lower Chena has doubtlessly occurred. This in turn could be depressing numbers of rearing grayling through a decrease in available food organisms. Studies addressing this possibility are needed and should be conducted as soon as feasible, since the invertebrate population of the lower river has now had time to stabilize at a new level.

Table 3. Grayling population estimates in four sections of the Chena River 1980. Only grayling greater than 150 mm fork length are included in the estimate.

Section (River Mile)	Date	Length of Section (Mi)	Schnabel Estimate Gr/mi	Schumacher-Eschmeyer Estimate Gr/mi	90% Confidence Limits for Schumacher-Eschmeyer Gr/mi
2b (8-11)	July 1-4	3	463	493	366-754
8a (26-29)	July 14-17	3	284	304	247-396
Dam Site (46-49)	July 29-Aug 1	3	339	377	320-459
10b (66-69)	Aug 12-15	3	1,163	1,348	1,024-1,974

Table 4. Population estimates for Arctic grayling greater than 150 mm fork length in index sections of the Chena River 1968-1980.

River Section	Year	Dates	Grayling per Mile
2b	1968		1,095
	1969		1,890
	1970	July 2-10	1,479
	1971	Aug 30-Sept 3	2,095
	1972	June 22-26	978
	1973	July 3-10	679
	1974	July 25-28	642
	1976	July 22-24	654
	1977	July 11-14	511
	1978	July 25-28	259
	1979	July 26-30	321
	1980	July 1-4	493
8a	1979	Aug 20-23	283
	1980	July 14-17	304
Dam Site	1972	June 27-29	1,306
	1973	July 18-19	800
	1974	July 9-11	416
	1976	Aug 4-6	489
	1977	July 26-30	507
	1978	Aug 8-11	553
	1979	July 17-20	308
	1980	July 29-Aug 1	377
10b	*1971	June 7-July 7	1,873
	1980	Aug 12-15	1,348

* The 1971 estimate was conducted on the entire 16 miles of Section 10.

Age and Length Structure

Age determinations by scale analysis were made from a random subsample of 251 grayling (scales collected from every fourth fish captured). Age and length information presented in Table 5 show clearly that Age Class III was the predominant age class, comprising 38.6% of the entire sample, with Age Class IV having 28.2% and Age V 13.1%. Table 6 compares age class composition of grayling sampled in the index sections using electrofishing gear with that of the fish sampled from the sport caught creel (hook and line), from 1976 through 1980. The dominant age classes in the 1980 index sections, Ages III and IV, were the result of strong year class recruitment of the 1977 and 1978 fish.

In both 1979 and 1980, Age Classes III and IV together represented 63% and 67% respectively of the total sample in the index areas. In 1979 Age Classes III and IV sampled from the creel accounted for 71% of the fish caught and almost 60% in 1980.

The length frequency in percent of sample in each section appear in Table 7. While the mean fork lengths of the four samples are similar, it is obvious that the lower river harbors predominantly (96%) immature grayling (less than 270 mm - Roguski and Tack 1970). The large percentage of smaller fish in the lower 75 mi of the Chena River was also evident during the 1980 tagging study (refer to section on tagging study), where 94.6% of 3,269 grayling captured were less than 270 mm fork length. The fork length range and mean fork length in each section increases slightly from one section to the next in an upstream direction. The mean fork length of the four index areas was 191 mm, which was exactly the same as in 1979 (Hallberg 1980). The five-year average for the mean fork length in the index areas is 192 mm.

Upper Chena River Creel Census

For the second consecutive year the Sport Fish Division, working in an agreement with the Alaska Cooperative Fisheries Research Unit of the University of Alaska, Fairbanks, has employed the services of graduate student Roland Holmes in collecting creel census information along the upper Chena River as part of Mr. Holmes on-going research on the harvest and rate of exploitation of Chena River Arctic grayling.

Because of unseasonably mild temperatures through late winter and early spring of 1980, ice movements associated with break-up began in late April. However, break-up on the Chena River did not occur as rapidly or violently as in normal years and in 1980 amounted to nothing more than a gentle melt-out. By the second week in May the river had dropped to its summer level and the sport fishing season began.

Due to the early break-up, creel census along the upper Chena River also began about 2 weeks ahead of other years, continued through the summer and terminated at the end of September.

Table 5. Age and length composition of 251 randomly subsampled grayling in Sections 2b, 8a, Chena River Dam Site and 10b, 1980.

Fork Length mm	Age Class I	II	III	IV	V	VI	VII	Total No.	Length Frequency %
100-109	2							2	0.8
110-119	1							1	0.4
120-129	0							0	...
130-139	1	1						2	0.8
140-149		8						8	3.2
150-159		14	6					20	8.0
160-169		6	3					9	3.4
170-179		2	8					10	4.0
180-189			10					10	4.0
190-199			22	1				23	9.2
200-209			18	2				20	8.0
210-219			19	9				28	11.2
220-229			8	17				25	10.1
230-239			3	22	3			28	11.2
240-249				17	4			21	8.4
250-259				2	9			11	4.4
260-269				1	11			12	4.8
270-279					4	4		8	3.2
280-289					2	2		4	1.6
290-299						5		5	2.0
300-309						1		1	0.4
310-319							1	1	0.4
320-329							1	1	0.4
330-339							0	0	...
340-349							1	1	0.4
n	4	31	97	71	33	12	3	251	
Age frequency %	1.6	12.4	38.6	28.2	13.1	4.8	1.2		
$\bar{x}$ fork length (mm)	114	154	198	231	259	292	327		

Table 6. Comparison of age composition percent between creel (hook & line) and index sampling (electrofishing gear), Chena River 1976-1979.

Age Class	1976		1977		1978		1979		1980	
	Creel	Index	Creel	Index	Creel	Index	Creel	Index	Creel	Index
I	N/A	10	1	6	2	15	0	11	5.2	2
II	N/A	24	13	34	22	38	0	20	12	12
III	N/A	29	44	44	61	22	23	46	35	39
IV	N/A	15	22	8	10	20	48	17.5	22	28
V	N/A	9.5	15	6	2	3.5	15	5	18	13
VI	N/A	11	4	2	0.5	1	6	0.5	5	5
VII	N/A	1.5	1	0	2.5	0.5	7	0	1.5	1
VIII	N/A	0	0	0	0	0	1	0	1.5	0
Number in Sample		256	119	229	115	268	86	218	288	251

Table 7. Length frequency (in percent of sample) of 1,546 grayling from four sections of the Chena River, 1980.

Fork Length mm	Chena River Sections			
	2b	8a	Dam Site	10b
90 - 99	0.4	...	...	...
100 - 109	1.0	0.3	...	...
110 - 119	2.9	...	0.4	...
120 - 129	3.2	2.3	...	...
130 - 139	3.4	4.4	2.2	0.7
140 - 149	6.5	9.7	13.4	8.9
150 - 159	15.4	13.4	4.7	12.0
160 - 169	18.3	8.2	3.4	7.5
170 - 179	13.8	4.1	2.6	3.6
180 - 189	4.1	3.2	1.7	2.2
190 - 199	3.0	9.9	9.1	4.4
200 - 209	5.4	9.1	18.1	6.7
210 - 219	7.2	9.7	13.4	11.6
220 - 229	4.8	11.1	10.3	8.2
230 - 239	3.6	7.3	5.2	12.3
240 - 249	3.4	4.4	3.9	7.7
250 - 259	1.0	1.7	2.2	4.1
260 - 269	1.4	0.6	3.4	2.4
270 - 279	1.0	...	0.9	2.9
280 - 289	0,2	0.3	2.1	1.0
290 - 299	...	...	0.4	2.2
300 - 309	...	...	1.3	1.0
310 - 319	...	...	...	0.2
320 - 329	...	...	1.3	0.2
330 - 339	...	...	...	...
340 - 349	...	0.3	...	...
350 - 359	...	...	...	...
360 - 369	...	...	...	...
370 - 379	...	...	...	0.2
Number	557	342	232	415
Mean Length (mm)	178	186	204	206
Length Range (mm)	95-280	105-346	115-327	132-371

Results of the 144-day creel census appear in Table 8. During this time it was calculated that a total of 20,827 angler hours was expended to harvest nearly 16,400 grayling along the upper river above mile 26 of the Chena Hot Springs Road. The average size grayling found in the creel was 228 mm (9 inches); the catch was 0.78 grayling caught and kept per angler hour.

Low water levels coinciding with the major upstream migration of grayling accounted for the unusually high-use figures for the month of May. The mean fork length of those grayling sampled from the creel during May of 1980 was 248 mm, much larger than the 1969 mean of 219 mm for the entire summer, (Hallberg 1980). These larger fish are considered to be part of the upstream spawning run of Chena River grayling. The pressure (angler-hours) remained fairly constant through August then dropped off in September, probably due to the cooler temperatures and hunting seasons. The harvest and the catch per angler-hour peaked in May and June and then again in August, with a lull occurring in July. The low figures for the month of July may be the result of a change in the feeding patterns of grayling. Chinook and chum salmon enter the Chena River in early July to spawn. Grayling were observed concentrating at the downstream ends of the salmon spawning redds, feeding on the salmon eggs that drift down during spawning activity. Stomachs of grayling captured by the electrofishing boat during population estimates in July were filled with chinook salmon eggs.

Table 8 also illustrates the angler composition. Adult male Fairbanks residents comprise the majority of anglers who utilizes the upper Chena River.

A summary of creel census results for the upper Chena River since 1970 appears in Table 9. Although the total angler-hours and grayling harvest are higher in 1980 due to the longer census period as compared to previous years, the catch per angler-hour of 0.78 compares closely with that of 1979 (0.82) and also with the 8-year average of 0.75 grayling per angler-hour. For the convienence of comparing the 1980 creel census results for the 3-month period of June, July and August with those of past years, the results are as follows: total 1980 grayling harvest 10,761, total angler hours 14,355, and the grayling caught and kept per angler hour, 0.75. All three figures compare extremely closely to the 1979 results. The addition of May and September data in 1980 accounts for the differences.

The age and length composition of 288 Arctic grayling subsampled from the creel appear in Table 10; Age Classes III and IV make up 57% of the creel. Table 6, in the Population Estimate section, shows that Age Classes III and IV have contributed more than 60% of the creel every year since 1977. Twenty-one percent of the sample were adult grayling (greater than 270 mm). This number is larger than the 13.8% adults in 1979, and 13.1% in 1978 (Kramer 1979). The average size grayling in the subsample was 232 mm and the average in the overall census was 228 mm, this is larger than the 1979 average of 219 mm and that of the 5-year average from 1976 through 1980 of 225 mm. While fluctuations in length frequency and mean length frequency occur from year to year, approximately 50% or more of the grayling entering the creel in the upper Chena River each year are from the two strongest, best represented age classes.

Table 8. Creel census results of the Arctic grayling fishery on the upper Chena River adjacent to the Chena Hot Springs Road, 1980.

Period	Angler Hours	Grayling Harvest	Grayling Kept Angler/Hr	Mean Grayling Fork Length (mm)
May 8-31	4,403	4,139	0.94	248
June	5,160	3,875	0.72	231
July	4,594	1,564	0.54	208
August	4,601	5,322	1.0	236
September	2,069	1,490	0.72	...
Total	20,827	16,390	0.78	228

Angler Composition (%)

Local Residents	74.8
Military	12.9
Tourist	12.3
Male	75.3
Female	24.7
Adult	81.8
Youth	18.2

Table 9. Summary of creel census results for the upper Chena River, 1970-1980.*

Year	Dates	Days	Total Angler Hours	Total Grayling Harvest	Grayling Caught & Kept Per Angler Hour
1970	May 1-31 July 14-Aug. 29	78	12,518	6,770	0.54
1974	July 1-Aug. 31	62	11,680	18,049	1.55
1975	June 1-Aug. 31	92	22,657	14,067	0.62
1976	June 1-Aug. 31	92	10,762	4,161	0.39
1977	June 1-Aug. 31	92	13,536	9,406	0.69
1978**	May 29-Aug. 31	95	10,508	6,898	0.65
1979	June 1-Aug. 31	92	12,744	10,459	0.82
1980	May 8-Sept. 30	144	20,827	16,390	0.78

* Data before 1978 taken from Hallberg, 1978.
** Data taken from Kramer, 1979.

Table 10. Age and length composition of 288 grayling sampled from creel census on upper Chena River May-Sept. 1980.

Fork Length mm	Age Class I	II	III	IV	V	VI	VII	VIII	Total No.	Length Frequency %
140-149	2								2	0.7
150-159	3								3	1.0
160-169	2								2	0.7
170-179	3	2							5	1.7
180-189	3	9	1						13	4.5
190-199	2	5	2						9	3.2
200-209		9	23	3					35	12.1
210-219		8	22	4					34	11.8
220-229		2	28	12					42	14.6
230-239			17	8	2				27	9.4
240-249			8	12	4				24	8.3
250-259				13	6	1			20	6.9
260-269				3	9	...			12	4.1
270-279				6	11	1			18	6.2
280-289				2	12	1			15	5.2
290-299					2	7			9	3.2
300-309					5	2	1		8	2.7
310-319					2	1	0		3	1.0
320-329							2		2	0.7
330-339							0	1	1	0.4
340-349							0	0		
350-359							1	0	1	0.4
360-369								1	1	0.4
370-379								1	1	0.4
380-389								0		
390-399								0		
400-409								1	1	0.4
n	15	35	101	63	53	13	4	4	288	
Age Frequency %	5.2	12.2	35.0	21.9	18.4	4.5	1.4	1.4		
$\bar{x}$ fork length (mm)	170	197	220	243	271	292	327	370	232	

Tagging Study

In an attempt to understand more about the grayling population structure and intra-stream movements in the Chena River, an intensive tagging study was initiated in June of 1980. By tagging we hoped to learn if the younger grayling concentrate in the lower 50 mi of the Chena River and then move upstream in their second and third years of life as has been theorized. We also hope to learn if the lower river grayling in general move into the upper, more heavily utilized areas of the Chena, replacing the thousands of grayling that are being harvested during the summer months. Because of the sampling gear used (electrofishing boat) the capture of young-of-the-year and Ages I and II grayling is extremely difficult. Seine hauls along gravel bars, made in an attempt to capture smaller fish, also met with marginal success as only a few fish were captured with this technique. Only grayling 150 mm fork length and larger were tagged with a Floy, numbered internal anchor tag. Their fork lengths, along with date and location were recorded. A total of 3,000 grayling was tagged in the lower 75 mi of the Chena River during the 1980 field season.

Tag returns come from anglers and through staff efforts as tagged grayling are recaptured during the field season. Each recapture is considered an initial capture, and a "movement" is defined as a recaptured tagged grayling that traveled 5 mi or more from the location where it was originally tagged.

Movements of recaptured grayling in the Chena River for the summer 1980 appear in Table 11. In May and June most grayling that moved did so in the upstream direction. A total of 71 fish was tagged in May. Of these six were recaptured; the average number of days between the tagging and recapture was 29. Five of these fish moved upstream an average of 22 mi and one moved downstream 10 mi. In June 1,599 fish were tagged, of which 87 were recaptured an average of 42 days later. Fifty-two, or 60%, of those recaptured showed no apparent movement.

Of 35 fish that did move, 33 moved upstream an average of 16 mi, while only two moved downstream approximately 5 1/2 mi. In July and August 1,330 grayling were tagged and only four were recaptured. The reason for such a low recapture and lack of any significant movements during this time is probably because the summer distribution of grayling remains fairly stable once the spring migration is completed. Anglers in July and August had a larger number of tagged grayling from which to draw but a shorter period of time in which to catch them in. Table 12 shows the fork length range and mean fork lengths of tagged grayling by river mile. Only fish 150 mm or greater in length were tagged. There does not appear to be a significant increase in the mean fork lengths of grayling from one area to the next above mile 37.

While there is a slight increase in mean fork length, the majority of the grayling handled were in the 188-230 mm range (mean of 218), which represents Age Classes III and IV.

Table 11. Movements of tagged grayling in the Chena River 1980.

Month	No. Fish Tagged	No. Fish Recaptured	No. Moved Upstream	$\bar{x}$ Distance Traveled Upstream(Mi)	no. Moved Downstream	$\bar{x}$ Distance Traveled Downstream(Mi)	No Apparent Movement	Average No. of Days Between Tag & Recapture
May	71	6	5	22	1	10	0	29
June	1,599	87	33	16	2	5.5	52	42
July	1,245	3	1	6	0	0	2	12
Aug	85	1	0	0	0	0	1	8
Total	3,000	97	39	17 mi	3	7 mi	55	40 days
Percent of recaptured grayling			40		3		57	

Table 12. Fork length range and mean fork length by river mile of 3,269* grayling tagged or handled during tagging and population studies in 1980.

Mile	Number of Fish	Fork Length (mm)	
		Range	Mean
8 - 11	460	150-280	188
27 - 30	285	150-346	198
37 - 41	285	158-306	215
41 - 45	262	157-345	212
45 - 48	198	150-327	216
50 - 51	72	154-300	221
51 - 52	80	180-290	223
53 - 54	73	178-310	231
54 - 56	83	159-317	228
57 - 60	105	153-376	229
61 - 64	509	158-332	221
65 - 69	674	150-371	224
70 - 76	183	166-315	233
Total	3,269		218

* 3,000 grayling were tagged; an additional 269 fish were finclipped.

Stream Surveys

Stream surveys conducted in the 1980 field season were only preliminary. Complete survey data and information as it becomes available will be included in future years' reporting.

Development Projects Affecting the Chena River

The Chena River Lakes project was authorized by the Flood Control Act of August 13, 1968, Public Law 90-483, section 203, 90th congress (s-3710), in accordance with the recommendations of the Chief of Engineers. This authorization came in the aftermath of the devastating flood of August, 1967 when flows of 74,400 c.f.s. were recorded on the Chena River at Fairbanks (the Chena River at Fairbanks floods at 12,000 c.f.s.).

The Alaska District of the U.S. Army Corps of Engineers began construction on the project in 1972. A river control structure on the Chena River and connecting diversion dike and floodway were built to divert flood water from the Chena River directly into the Tanana River, thus protecting the City of Fairbanks. A levee on the north side of the Tanana River was also constructed to protect Fairbanks, in this case from the rising waters of the Tanana River. The project, because of its enormous size and complexities, coupled with the fact that the Corps of Engineers is working with a braided river (the Tanana) which, even they admit, their knowledge and experience with this type of river system is very limited, has been the subject of much controversy and, at times, opposition from local, State and Federal agencies and the private sector alike. Completion date for the project is the summer of 1981; however, the recreation area associated with the project has been delayed due to federal budget cuts.

In 1980 work on the project centered around the installation of the fish ladder at the Chena River control structure. This phase of the project was not completed until December, 1980.

Fish passage has been insisted upon by State and Federal resource agencies since the project was first conceived. Fish passage during normal flows would be accomplished through the open flood gates. A "fishway" with roughened channel surfaces to reduce velocities was installed to provide passage for smaller fish and those with limited swimming abilities. During times of flooding, when the gates at the control structure are closed, the fish ladder would allow fish to pass. The installation of the "Hell's Gate" vertical slot type fish ladder in 1980 completes those structures incorporated into the design to accomodate fish passage.

While the question of fish passage would appear to be solved, their remains one critical flaw in the design. The fish ladder installed in the Chena River Lakes flood control project does not become operable until water level on the upstream side of the control structure reaches an elevation of 502 ft (normal Chena levels here are around 486 ft). During major flood events this elevation (502 ft) could be achieved in a short period of time, 1 or 2 days, perhaps only hours. However, in many years of smaller flood events (the 2-year event), the time it takes to bring the water levels

behind the dam to elevation 502 ft may be days, weeks or may never happen. This delay could have severe impacts on both upstream-migrating grayling and out-migrating salmon smolts. Efforts are being made to work with the Corps in addressing this problem and to come up with a flood control regulation scheme that would shorten this delay period to minimize impact on the fisheries and still provide flood protection to the residents of Fairbanks.

Testing of the flood control project is scheduled for the spring of 1981. Sport Fish Division plans during times of testing to include observations as to the success of the fish ladder in passing fish and monitoring drawdown operations to identify the areas of fish entrapment and assess the numbers of fish trapped in the floodway.

The newly-created Chena Lake was test netted in 1980. Seven species of fish were present in the lake, they were longnose sucker, northern pike, humpback whitefish, round whitefish, least cisco, Arctic grayling and burbot. Water chemistry in Chena Lake is as follows: total hardness = 154 ppm, pH = 7.8, COH_2 = 10 ppm, total acidity = 34 ppm, and total alkalinity 120 ppm $CaCo_3$. Dissolved oxygen levels in March 1980 were recorded at 1 ppm at 30 ft and 5-7 ppm at 10 ft. Current Sport Fish Division plans are to chemically treat Chena Lake to remove the present species, and introduce a species of fish desirable to the sport fisherman.

Young-of-the-year and Age Class I grayling were observed in the interior drainage channel B, which empties directly into the Chena River, in late summer and early fall. The interior drainage channels are designed to funnel back to the Chena or Tanana Rivers, surface water and waters originating from increased levels within the water table below the impoundment area. More investigation into the use of these channels by fish is needed to assess their potential importance as fish habitat.

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